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**G07D 7/00**

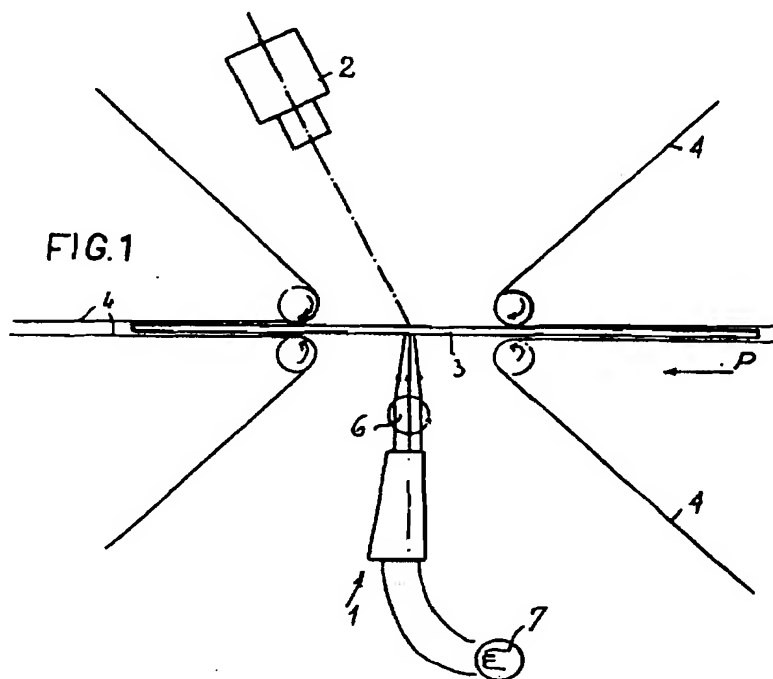
(52) UK CL (Edition O )  
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**U1S S2272**

(56) Documents Cited  
**EP 0537513 A1**

(58) Field of Search  
UK CL (Edition O ) **G1A AAJP AMBP AMK**  
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## (54) Checking optical security features on bank notes

(57) Optical security features, e.g. in the form of metallic reflecting layers, in bank notes 3 or the like are checked by moving the bank notes using transport belts 4 past a light source 1, preferably infrared operating between 800-1000nm and having a cylindrical lens 6, on one side of the bank note and scanning the security feature by means of an electronic camera 2, preferably a CCD-Line-Scan, on the other side of the bank note. The values measured by the camera relating to the intensity and distribution of the light passing through the bank note and through or around the security feature are compared with desired values to produce an indication of the quality or condition of the security feature. The axes of the light source and camera are inclined by an angle differing from 180° so that no light is directly incident on the detecting element of the camera.



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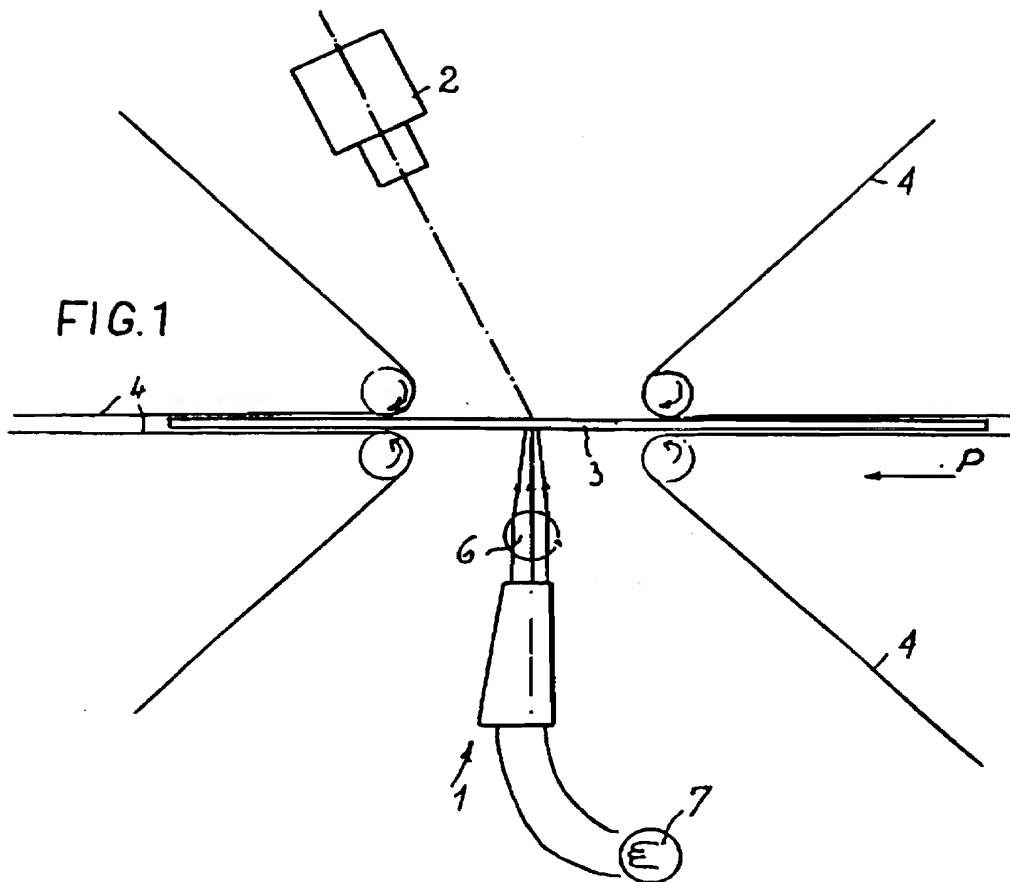
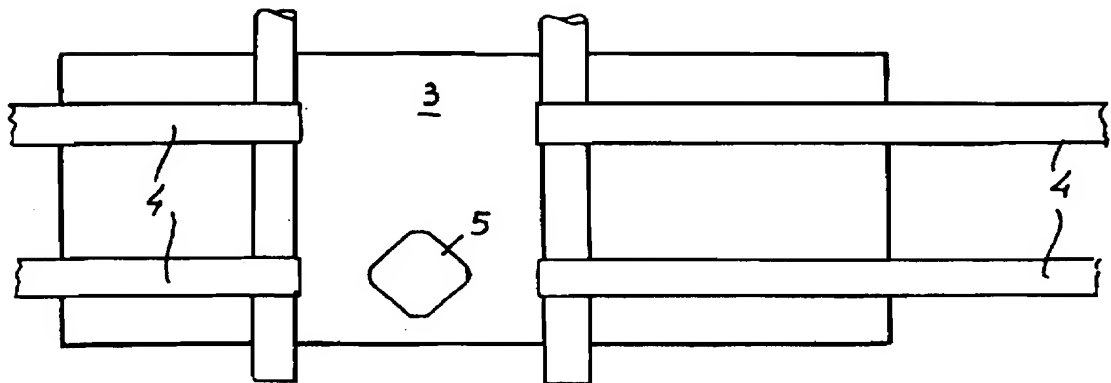


FIG. 2



Checking Optical Security Features on Bank  
Notes or the like and Apparatus for Carrying  
out the Method.

5       The invention relates to a method and apparatus for  
checking optical security features, e.g. in the form of  
metallic reflecting layers, such as kinegrams, holograms  
and the like on bank notes and other valuable documents.  
The invention thus relates in practice to checking the  
10       condition or quality of such security features or their  
registration, that is to say the positional accuracy of  
the security features or of their component parts  
relative to one another.

15       Optical security features on valuable documents, such as  
the kinegram on the Austrian S 5000 bank note, are  
currently checked manually or visually for damage,  
accuracy of registration, exact edge definition etc. A  
visual examination may be effected in the course of bank  
20       note production or even when the kinegram is applied  
during the paper manufacture, or film processing in the  
case of synthetic paper, or alternatively when sorting  
out notes coming back out of circulation. This procedure  
is labour-intensive and it is thus desirable to provide  
25       a less labour-intensive method which is, however,  
objective and thus independent of the person performing  
the check.

30       EP-A 92691 discloses an apparatus for detecting security  
strips in bank notes. Instead of mechanically measuring  
the thickness, it is proposed in this document that the  
material specific absorption bands of a plastic security  
strip be measured with two transillumination measuring  
channels in the infra-red range at wavelengths of about  
35       5  $\mu$  or that a metallic security strip in the paper be  
detected. An examination as to the quality or condition

of optical security features, which are reflective, such as reflex holograms or kinegrams, is not described in this document and nor would it be even possible with the known apparatus or evaluation method. The structure which is necessary for measurements in the range of 5  $\mu$  is also very complex due to the necessary cooling of the detector and the IR emitter.

GB-A 2160644 discloses the use of a Line-Scan camera to scan a valuable document (bank note), which is guided over a rotating cylinder, parallel to the axis of the cylinder with overhead illumination in order to obtain visual information which is then compared with information derived from an original. In order to obtain visual information from metallic layers, which are glossy and thus reflective, this process operating with overhead illumination is problematic due to the reflections which occur. Inaccurate results can be produced and can not be controlled.

CH-A 652355 discloses identity cards which have a special layered construction to enable them to be examined with overhead illumination and transillumination. Each layer is at least partially printed with a monochrome region and monochrome regions can also be printed on both surfaces of a single layer. The resulting printed image has light and shadow effects with overhead illumination which are reversed under transillumination. A spatial effect and a defined halftone graduation of the printed image can be produced by virtue of the number and arrangement of the individual printed layers. This method requires two pieces of information obtained by different processes in order to test an identity card and is thus expensive and is problematic if metallic layers

are present due to the reflections which occur with overhead illumination.

5 DE-A 3811905 describes a method of automatically examining the authenticity of hologram information. This publication does not disclose the examination or, correspondingly, the classification of the quality of application of a kinegram or overhead light hologram on bank notes as regards registration accuracy (position and  
10 alignment with respect to printed elements), edge definition (fraying of the contour), completeness of the feature (holes, missing portions) etc. and nor would this be possible. A quality examination of security features, which may also be examined under overhead optical light,  
15 by examining the structure (information), as is described in the published German document, would not be successful in practice with reflective security features. Particularly when examining used bank notes, creases which are present and result in casual reflections, make  
20 structural examination practically impossible. Furthermore, regardless of the design, structures are not always present over the entire surface and instead only information-free (defective) metallised surfaces are imprinted in regions which thus excludes a quality check  
25 on the basis of a structural examination. The arrangement described in the German published document provides that the transmitter and receiver be arranged directly opposed to one another for the hologram examination under transillumination in order to be able  
30 to analyse the hologram information. An opposed arrangement of the transmitter and receiver would also have the consequence of a disadvantageous overload and possibly even damage of the receiving element due to the direct incidence of light on it through the spaces

between successive bank notes.

Accordingly, it is the object of the present invention to provide a method and apparatus for checking optical security features on bank notes or the like which avoids the disadvantages of the methods disclosed in the prior specifications referred to above.

According to the present invention there is provided a method of checking optical security features on bank notes or other valuable documents in which the security feature is illuminated from one side by means of a light source and is scanned from the other side by means of at least one electronic camera and the actual values thereby determined are compared with desired values in order to detect valuable documents with defective security features, the optical axis of the electronic camera being arranged at an angle differing from  $180^\circ$  to the optical axis of the light source.

The present invention also embraces an apparatus for carrying out such a method and such an apparatus includes transport means for moving the valuable documents along a transport path, a light source arranged on one side of the transport path to illuminate the security features, an electronic camera arranged on the other side of the transport path to scan the security features, the optical axes of the camera and the light source defining an angle differing from  $180^\circ$ , and evaluation means arranged to compare the values determined by the camera with desired values and to produce an indication when there is a significant difference therebetween.

The comparison of the actual or measured values with the

desired values may be readily carried out by image evaluation and comparison methods which are well known per se. The actual and desired values may be representative of any parameter or parameters which may be determined by scanning such as the shape of a security feature or values representative of light intensity or light intensity distribution over a predetermined area.

It is preferred that the electronic camera is a CCD-Line-Scan camera and that the light source is an infra-red light source, preferably operating in a wavelength range of 800 to 1000 nm. The camera may, in particular, produce values representative of the actual contour of the security feature and these values are then compared with values representative of the desired contour.

The method in accordance with the present invention is therefore conducted with the aid of transillumination rather than overhead illumination and this means that reflections from reflective security features do not influence the measured values. Furthermore, a better contrast of the security features against symbols applied to the valuable document in the printing process is achieved. Due to the oblique arrangement of the camera and thus its receiving element with respect to the light source, the light passing through the paper adjacent the security feature, e.g. the metal layer, or due to damage thereof, such as holes or wear in the vicinity of creases, and scattered by the paper is measured. If the examination is effected with the use of an infrared light source, a better signal is produced when compared with the use of visible light since metallic layers absorb infra-red rays more strongly than the regions of the valuable document surrounding these layers.

An indication that a certain valuable document has a defective security feature may be used to reject that document during the manufacturing process or to separate it out in a sorting installation.

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By using a method in accordance with the invention it is possible on the one hand to carry out a quality check of the metallised and coated kinegram film (film compound of the kinegram), which is applied, often defectively, in a hot imprinting process, predominantly onto paper, and on the other hand to check, in accordance with the above criteria, the condition of bank notes with kinegrams coming back to the bank after circulation. Of particular significance in this connection is the fact that not only the quality check during note production but also the condition check during note sorting need no longer be conducted visually and thus with very high labour input. The automation of these checking processes is associated also with a substantial improvement in the quality of the checking.

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The apparatus in accordance with the invention is distinguished, in particular, by its simple construction. If the transport means is constituted by transport belts which engage the valuable document from above and below and clamp it between them it is moved through the checking apparatus in a particularly reliable manner without being deformed which would result in inaccurate information being received by the camera.

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One specific embodiment of the invention will be explained below in more detail by way of example with reference to the schematic drawings, in which:



Fig. 1 is a side view of an apparatus suitable for carrying out the method in accordance with the invention, and

5 Fig. 2 is a plan view of the apparatus of Fig. 1 from which the camera has been omitted.

The apparatus has an illumination device 1, which preferably includes a halogen lamp 7, for illuminating  
10 the image field of an electronic camera 2, which in this preferred embodiment is a CCD-Line-Scan camera. A valuable document 3 to be checked, e.g. a bank note, with an optical security feature 5 to be examined in the form of a metallic reflecting layer is moved in the direction  
15 of the arrow P past the camera 2 by a transport device constituted by transport belts 4. The camera 2 and the illumination device 1 are arranged on opposite sides of the transport path of the valuable document 3. The illumination device 1 is arranged to direct light  
20 perpendicular to the transport path. The camera is offset from the illumination device 1 in the direction of the transport path and is thus directed at an angle to the transport path which differs from 90°, whereby no light passing through a valuable document or between two  
25 spaced valuable documents can be directly incident on its light detecting element. The axes of the illumination device and the camera are in any event inclined to one another by an angle differing from 180°. A cylindrical lens 6 is disposed in the beam path of the illumination  
30 device 1. Glass fibre cables can be used as light guides. An infra-red source can also be used to "illuminate" the valuable document 3 and this source preferably operates in the wavelength range between 800 and 1000 nm. The signals from the camera 2 are supplied

to an image evaluating device, which is not shown and which is connected to a fluorescent screen on which the desired and actual values can be shown alpha-numerically or graphically.

CLAIMS

- 5        1.    A method of checking optical security features on bank notes or other valuable documents in which the security feature is illuminated from one side by means of a light source and is scanned from the other side by means of at least one electronic camera and the actual values thereby determined are compared with desired values in order to detect valuable documents with defective security features, the optical axis of the electronic camera being arranged at an angle differing from 180° to the optical axis of the light source.
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- 15        2.    A method as claimed in Claim 1 in which the electronic camera is a CCD Line-Scan camera.
- 20        3.    A method as claimed in Claim 1 or 2 in which the light source is an infra-red light source.
- 25        4.    A method as claimed in Claim 3 in which the infra-red light source is arranged to operate in the wavelength range of 800 to 1000 nm.
- 30        5.    A method as claimed in any one of the preceding claims in which the camera produces values representative of the actual contour of the security feature and these values are compared with values representative of the desired contour.
6.    Apparatus for checking optical security features on bank notes or other valuable documents including transport means for moving the valuable documents along a transport path, a light source arranged on one side of

the transport path to illuminate the security features, an electronic camera arranged on the other side of the transport path to scan the security features, the optical axes of the camera and the light source defining an angle differing from  $180^\circ$ , and evaluation means arranged to compare the values determined by the camera with desired values and to produce an indication when there is a significant difference therebetween.

7. Apparatus as claimed in Claim 6 in which the electronic camera is a CCD Line-Scan camera.

8. Apparatus as claimed in Claim 6 or 7 in which the light source is an infra-red light source.

9. Apparatus as claimed in Claim 8 in which the infra-red light source is arranged to operate in the wavelength range of 800 to 1000 nm.

10. Apparatus as claimed in any one of Claims 6 to 9 in which the transport means comprises two or more transport belts spaced apart in the direction transverse to the length of the transport path.

11. Apparatus as claimed in any one of Claims 6 to 10 in which a cylindrical lens is arranged in the beam path of the light source.



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Application No: GB 9605392.1  
Claims searched: 1-3 & 6-8

Examiner: Andrew Alton  
Date of search: 20 June 1996

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.O): G1A: AAJP, AMBP, AMK  
Int CI (Ed.6): G07D: 7/00  
Other: Online database: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0537513 A1 URMET - See Fig. 2 and col. 2, line 5 to col. 3, line 41	1-4,6-9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

